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AN INTEGRATED APPROACH FOR SITE SELECTION BY USING REMOTE SENSING AND DESIGN OF GROUP HOUSES IN AND AROUND VIJAYAWADA: A MODEL STUDY

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ABSTRACT

In order to competent in the ever growing competent market, it is very important for a structural engineer to save time. As a sequel to this, an attempt is made to analyse and design of Multi-storeyed Building by using a software package Staad Pro. In addition, the cost of the whole building has been estimated. Shelter is the basic necessity for everyone. The Rental market in Vijayawada for housing has been increased, as it became the new capital city of Andhra Pradesh, low and middle class people cannot afford this cost. So it is better to own a house with low cost. For analysing these low, medium and high income group houses one has to consider all the possible loadings and observe that the structure is safe against all possible loading conditions or not. The Staad Pro software is a very effective tool which can save much time and is very accurate in analysis and design. In connection to above mentioned, for low-cost housing, the site selection has been done by using GIS. The group housing is a better approach which decreases the overall cost of construction, which turns benefit to the people who owns this house. This construction based on special and individual needs by performing surveys on population needs and rational use of materials and resources.

Key words: Low, Medium and High Income Houses, Estimation, STAAD. Pro, RIS & GIS.

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1. INTRODUCTION

Now a day's group houses play a vital role. Group houses takes more time to complete construction compared to individual houses, but it can be overcome by increasing more manpower and a bit of extra time. The plans are drawn for the building as per G.O. No. 168. Now a day's high income people are interested in taking villas. But low income people are interested in taking a house with a single bedroom. Based on this analysis the different plans are given for different group people. For constructing group houses the selected site should be undergone for preliminary check. The surrounding areas of selected site should contain road facilities and water facilities

People are migrating from a rural area to cities like Kuala Lumpur, it gradually increases the population. So, the government categorized people based on their income levels [1, 2]. Affordable mass construction is not a simple process. Different regions must take into consideration [3]. Malaysia government committed to giving quality and affordable house for poor people. From seventh Malaysian plan, 20.7% of target units are constructed [4]. In developing countries like Iran, the construction industry was worked on mass housing program. Iran government has done construction of small house unit at the range of 75 to 120 m^2. For this construction, they not only considered clients requirement but also considered lowest possible cost [5]. Low income people lives lower than the social average level. There is no particular standard for low income houses [6]. For solving the housing problems of low income people government helps the macro-control for housing-market. The government planned 30 million square of public rental housing in three years [7]. Quality related issues play an important role in a mass housing project. Approximately 1-5% of total cost of the project can be influenced [8]. Using of GPG-probe vehicle was a recent technique for traffic monitoring, by using this overall cost is reduced. For this ArcGIS based hybrid topological map-matching algorithm is used to improve accuracy [9, 10]. ArcGIS is used to know geographic information and highway alignment. By improving the GIS with Partial swarm optimization it represents three dimensional highway alignments [11]. By using STAAD. Pro the results like support reaction, stress, displacement, moments are calculated. The efficient structure can be built-up by using STAAD.Pro [12]. Multi-storey buildings are constructed to reduce the area of the land it reduces the cost of the land [13]. Imposed loads are taken from IS: 875 (part 2) -1987 [14]. A framed structure with rigid joint transfer loads from the roof to columns, from columns to foundation. This indicates that stresses in soil were not exceeding allowable bearing capacity [15].

Group Development Scheme is the development of Residential Buildings in a Campus or Site of 4000 m^2 and above in area and could be row houses, semi-detached, detached Houses, apartment blocks or high-rise buildings or mix or a combination of the above.

1.1. Group Housing

Group housing means the development of building having five or more multiple dwelling units and common services on a given site or plot in a single or multiple blocks without customary subdivision of land by way of individual plots.

1.2. The Distance Provided for Buildings from Water Bodies

The distance of 100 m was provided from the boundary of the River outside the Municipal Corporation and 50 m was provided within the Municipal Corporation and 9 m from the boundary of the canal was certified by Irrigation Department. Vijayawada is located on the bank of river Krishna of which one river passes through the city. Also, 3 canals network systems provide water for drinking and farming.

1.3. Railways

The distance between the Railway Boundary and the edge of the building shall be 30 m as per Indian Railways Works Manual or as per No Objection Certificate (NOC) given by the Railway Authorities.

1.4. Occupational Pattern

The urban population in India has gone up five times in the last six decades. As per the 2012 census, over 30% of the total population comprises of the city workforce and the occupational pattern of Vijayawada indicates that it is a major centre for tertiary activities. While 69.37% of the total workers in 1991 belonged to the tertiary sector, the proportion has increased to 71.81% of the total workforce in 2012. On the other hand, there has been a decline in the proportion of workers in the secondary sector from 27.57% to 21.64% during 1991 and 2012 respectively.

2. OBJECTIVE

To study the need for examine the case of problems associated with implementation of low, medium, high income housing to ensure the success of future housing policy in proposed study area.

3. METHODOLOGY

3.1. Selection of Site for Construction

1. Google Earth is used for the selection of the site. Coordinates were taken from that particular site. Import that site in ArcGIS.
2. Assign the Coordinates of Google earth in ArcGIS. Georeferencing was done.
3. Shape files are drawn for particular Specification.

The below site is selected from ARCGIS. The proposed site was in between YSR colony and Rajarajeswari peta. Three places are selected for group houses. In the following Fig. 1, blue colour indicates water body, red colour indicates roadway, sky blue colour indicates railway track.

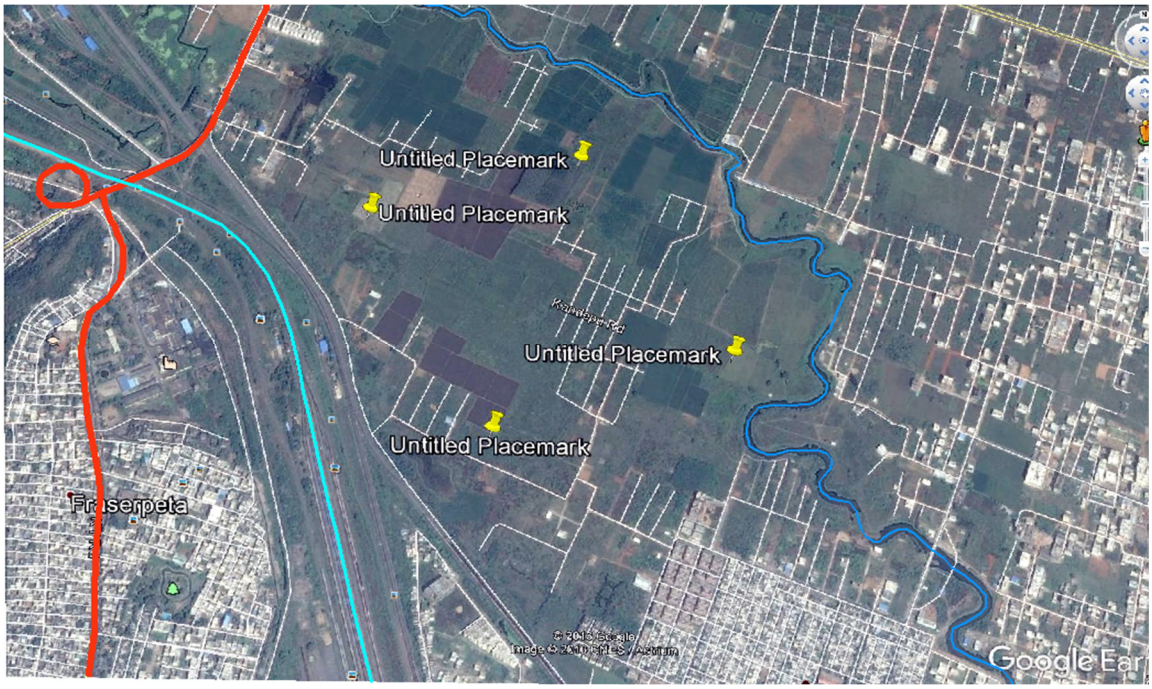

Figure 1 Selected Image of study area

3.2. Procedure for Modelling of the Building in staad.pro

1. Initially, open STAAD.pro profile. Select space and choose file location as well as set the length units in meters and force units in kilo Newton.
2. Assign the coordinate as per the building plan, After assigning of the co-ordinates click on add beam option and draw the beams and then click on general
3. Next, go to define option and select the rectangular section and assign its width and depth also select material as concrete.
4. Select all the beams and assign the section properties by clicking in assign to selected beams and columns also do the same then assigning is completed.
5. Assign the fixed supports as required then click add and assign the supports wherever required.
6. Assign the three load cases, load case1 for dead loads and load case2 for dead load and load case3 for a combination of loads.
7. In loadcase1 assign the self weight and then go to floor loads and assign that loads Click on uniform force and assign the wall loads as -14KN/m.
8. Now coming to loadcase2 assign the live load as -2KN/m2.
9. AS per IS 875 part-2, from table-2 is considered for providing live loads.
10. Now go to loadcase3 and assign the load combinations. Here both load case1 and 2 should be multiplied by a factor of 1.5.
11. In the top most floors we need to assign the wall loads. Since there are only parapet walls so assigning parapet wall loads as 2.5 KN/m in loadcase1.
12. Now go to design command and click on concrete and select define parameters depth and width of the cross-section can be assign. The yield strength of steel as 415000 Kn/m^2, character strength of concrete as 20000 KN/m^2, the minimum diameter of the bar as 8 mm.
13. Go to analysis/print option and click assign and press ok.
14. Finally, go to analysis option and run analysis was done, then the analysis is completed. Fig. 2 is showing that methodology flow chart.

3.3. Estimation and Costing

Estimation and costing is done by considering the Schedule of rates in Vijayawada (2016-2017)

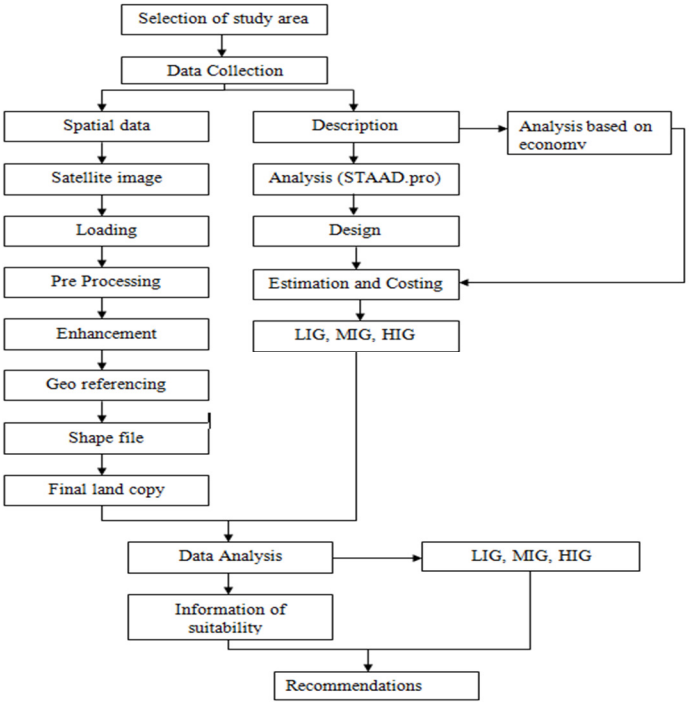

Figure 2 Methodology Flow Chart

4. RESULTS AND DISCUSSION

4.1. Low Income House

The area selected for low income house (G+1) is 45.28 m^2. The beam and column size considered for this building were 230 mm x 350 mm and 230 mm x 300 mm. As per estimation and costing the overall cost of this building was Rs.1070511. Table 1, shows that the forces and moments whereas Table 2, shows the reactions.

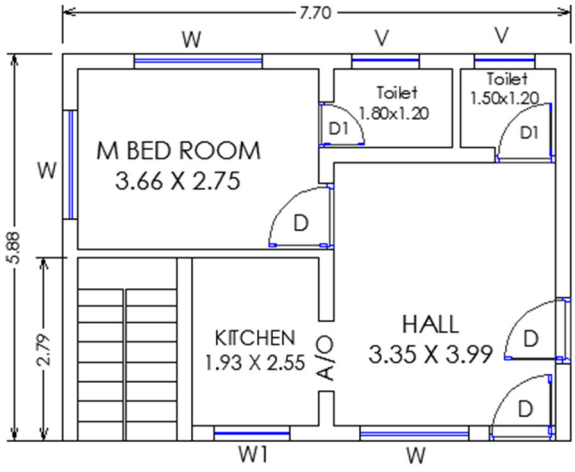

Figure 3 Proposed plan for LIG

Table 1 Forces and moments

Beam No.	Load Combination	Min/Max	F_x (kN)	F_y (kN)	F_z (kN)	M_x (kNm)	M_y (kNm)	M_z (kNm)
48	(DL+LL)1.5	Min	**-2.72**	59.10	0.09	4.63	-0.09	26.66
17	(DL+LL)1.5	Max	**449.33**	3.379	-2.32	0.05	-1.25	-1.99
64	(DL+LL)1.5	Min	-1.59	**-71.68**	0.07	2.93	0.08	49.37
46	(DL+LL)1.5	Max	-1.52	**63.86**	0.04	-3.92	-0.05	26.84
13	(DL+LL)1.5	Min	242.86	-19.26	**-8.65**	0.005	8.98	-21.11
21	(DL+LL)1.5	Max	230.13	17.24	**10.04**	0.09	-10.66	18.08
58	(DL+LL)1.5	Min	-1.49	-15.67	-0.07	**-5.98**	0.03	-20.81
55	(DL+LL)1.5	Max	-1.47	51.47	-0.005	**7.54**	0.01	25.64
21	(DL+LL)1.5	Min	230.13	17.24	10.04	0.09	**-10.66**	18.08
13	(DL+LL)1.5	Max	242.86	-19.26	-8.65	0.005	**8.98**	-21.11
64	(DL+LL)1.5	Min	-1.59	-9.46	0.07	2.93	-0.07	**-38.25**
64	(DL+LL)1.5	Max	-1.59	-71.68	0.07	2.93	0.08	**49.37**

* DL, Dead load; LL, Live load

Table 2 Reactions

Node No.	Load Combination	Min/Max	F_x (kN)	F_y (kN)	F_z (kN)	M_x (kNm)	M_y (kNm)	M_z (kNm)
18	(DL+LL)1.5	Min	**-17.24**	236.63	-10.04	-4.4	0.09	7.77
10	(DL+LL)1.5	Max	**19.26**	249.35	8.65	3.99	0.005	-7.78
18	LL	Min	0.07	**7.16**	0.04	0.01	-0.003	-0.01
14	(DL+LL)1.5	Max	-3.37	**449.33**	2.32	1.25	0.05	1.99
18	(DL+LL)1.5	Min	-17.24	236.63	**-10.04**	-4.4	0.09	7.77
10	(DL+LL)1.5	Max	19.26	249.35	**8.65**	3.99	0.005	-7.78
18	(DL+LL)1.5	Min	-17.24	236.63	-10.04	**-4.4**	0.09	7.77
10	(DL+LL)1.5	Max	19.26	249.35	8.65	**3.99**	0.005	-7.78
17	(DL+LL)1.5	Min	2.01	380.76	-7.11	-3.01	**-0.04**	-0.62
18	(DL+LL)1.5	Max	-17.24	236.63	-10.04	-4.4	**0.09**	7.77
10	(DL+LL)1.5	Min	19.26	249.35	8.65	3.99	0.005	**-7.78**
18	(DL+LL)1.5	Max	-17.24	236.63	-10.04	-4.4	0.09	**7.77**

* DL, Dead load; LL, Live load

4.2. Medium Income House

The area selected for medium income house (G+1) is 60.94m^2. The beam and column size considered for this building were 230 mm x 350 mm and 230 mm x 300 mm. As per estimation and costing, the overall cost of this building was Rs.1876608. Table 3, shows that the forces and moments whereas Table 4, shows the reactions.

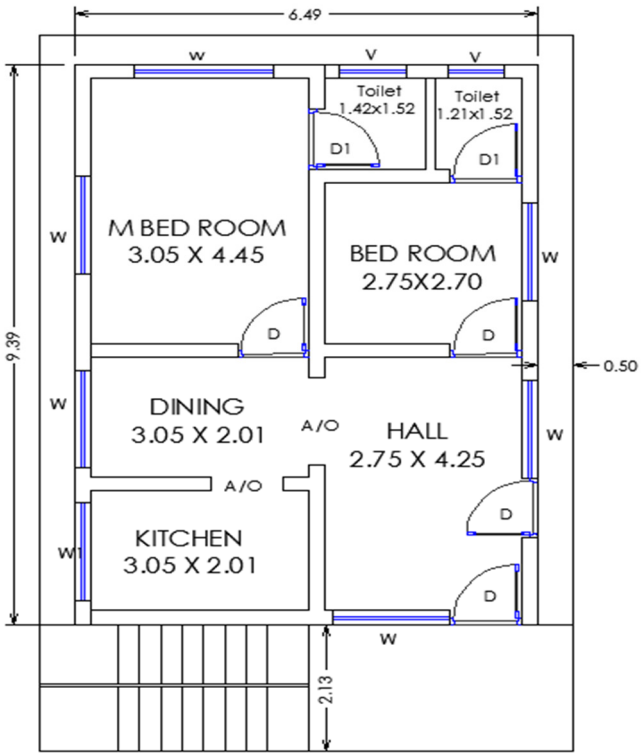

Figure 4 Proposed plan for MIG.

Table 3 Forces and moments

Beam No.	Load Combination	Min/Max	F_x (kN)	F_y (kN)	F_z (kN)	M_x (kNm)	M_y (kNm)	M_z (kNm)
96	(DL+LL)1.5	Min	**-6.48**	76.85	0.07	4.70	-0.12	49.34
17	(DL+LL)1.5	Max	**555.60**	1.46	2.84	0.01	2.50	-0.70
104	(DL+LL)1.5	Min	-1.84	**-83.99**	0.14	2.34	0.18	69.97
95	(DL+LL)1.5	Max	-1.42	**80.90**	0.16	4.25	-0.16	62.45
21	(DL+LL)1.5	Min	290.19	12.87	**-26.62**	0.08	29.74	13.41
13	(DL+LL)1.5	Max	261.65	-11.45	**20.64**	0.05	-21.30	-12.04
97	(DL+LL)1.5	Min	-4.30	77.49	0.14	**-5.53**	-0.15	64.18
106	(DL+LL)1.5	Max	-0.28	-9.17	-0.10	**5.17**	0.05	-23.16
116	(DL+LL)1.5	Min	98.94	0.127	19.31	0.02	**-29.90**	-0.30
21	(DL+LL)1.5	Max	290.19	12.87	-26.62	0.08	**29.74**	13.41
103	(DL+LL)1.5	Min	-6.28	7.21	0.15	-3.15	-0.22	**-45.85**
103	(DL+LL)1.5	Max	-6.28	-81.89	0.15	-3.15	0.24	**73.77**

Table 4 Reactions

Node No.	Load Combination	Min/Max	F_x (kN)	F_y (kN)	F_z (kN)	M_x (kNm)	M_y (kNm)	M_z (kNm)
18	(DL+LL)1.5	Min	**-12.87**	296.69	26.62	10.19	0.08	5.89
10	(LL+LL)1.5	Max	**11.45**	268.14	-20.64	-9.65	0.05	-5.14
12	LL	Min	0.02	**9.67**	0.19	0.05	-0.002	-0.01
14	(DL+LL)1.5	Max	-1.46	**555.60**	-2.84	-2.50	0.01	0.70
10	(DL+LL)1.5	Min	11.45	268.14	**-20.64**	-9.65	0.05	-5.14
18	(DL+LL)1.5	Max	-12.87	296.69	**26.62**	10.19	0.08	5.89
10	(DL+LL)1.5	Min	11.45	268.14	-20.64	**-9.65**	0.05	-5.14
18	(DL+LL)1.5	Max	-12.87	296.69	26.62	**10.19**	0.08	5.89
16	LL	Min	-0.04	12.37	-0.27	-0.10	**-0.005**	0.01
17	(DL+LL)1.5	Max	2.48	420.79	17.56	6.63	**0.09**	-0.88
10	(DL+LL)1.5	Min	11.45	268.14	-20.64	-9.65	0.05	**-5.14**
18	(DL+LL)1.5	Max	-12.87	296.69	26.62	10.19	0.08	**5.89**

4.3. High Income House

The area selected for high income house is 161.49 m^2. The beam and column size considered for this building were 230 mm x 380 mm and 230 mm x 380 mm. As per estimation and costing, the overall cost of this building was Rs. 4465175. Table 5, shows that the Forces and moments whereas Table 6, shows the reactions.

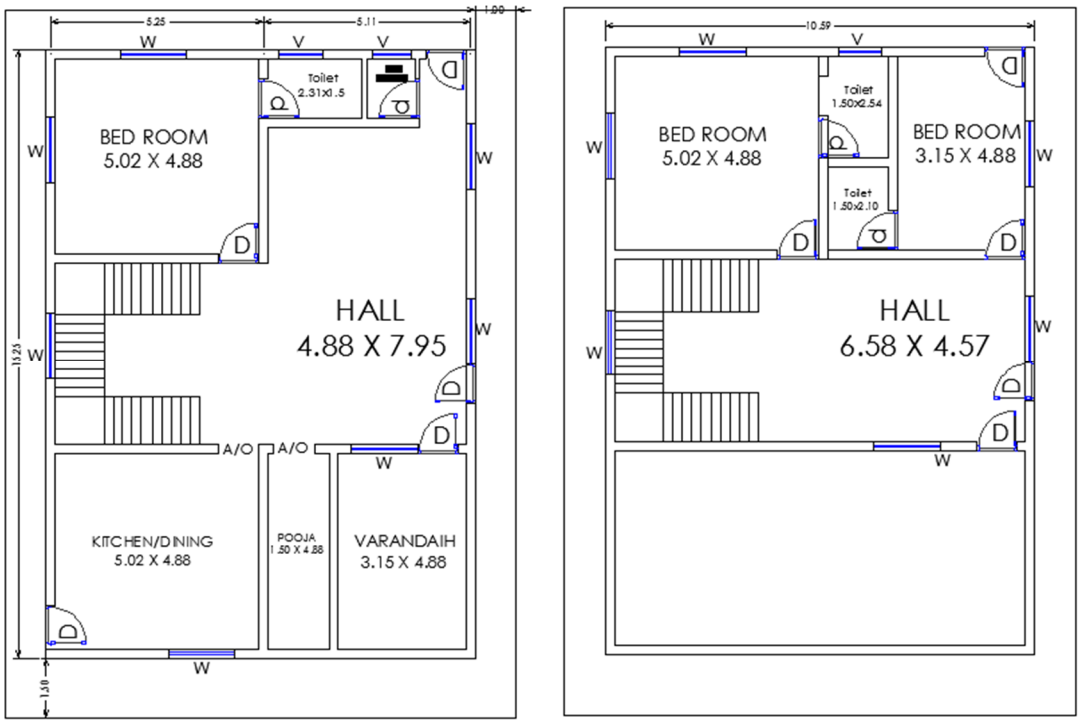

Figure 5 Proposed plan for HIG

Table 5 Forces and moments

Beam No.	Load Combination	Min/Max	F_x (kN)	F_y (kN)	F_z (kN)	M_x (kNm)	M_y (kNm)	M_z (kNm)
113	(DL+LL)1.5	Min	**-14.001**	140.56	0.015	0.02	-0.03	140.33
45	(DL+LL)1.5	Max	**1206.26**	0.24	11.632	-0.06	6.96	-0.21
102	(DL+LL)1.5	Min	-10.78	**-153.97**	-0.084	0.50	-0.23	173.87
103	(DL+LL)1.5	Max	-11.60	**183.34**	0.154	21.09	-0.14	176.69
148	(DL+LL)1.5	Min	206.63	1.92	**-43.429**	0.02	64.28	3.01
139	(DL+LL)1.5	Max	210.88	-4.68	**42.421**	-0.06	-65.09	-8.16
101	(DL+LL)1.5	Min	-5.50	145.25	-0.1	**-19.67**	0.06	133.89
103	(DL+LL)1.5	Max	-11.60	183.34	0.154	**21.09**	-0.14	176.69
148	(DL+LL)1.5	Min	197.36	1.92	-43.429	0.02	**-66.04**	-2.77
148	(DL+LL)1.5	Max	206.63	1.92	-43.429	0.02	**64.28**	3.01
129	(DL+LL)1.5	Min	-11.66	9.51	-0.076	-9.19	0.08	**-95.10**
103	(DL+LL)1.5	Max	-11.60	183.34	0.154	21.09	-0.14	**176.69**

Table 6 Reactions

Node No.	Load Combination	Min/Max	F_x (kN)	F_y (kN)	F_z (kN)	M_x (kNm)	M_y (kNm)	M_z (kNm)
35	(DL+LL)1.5	Min	**-45.11**	470.08	37.57	14.65	-0.10	19.24
13	(DL+LL)1.5	Max	**29.22**	419.14	21.60	9.80	0.06	-12.45
35	LL	Min	0.47	**23.74**	-0.38	-0.06	0.01	-0.10
39	(DL+LL)1.5	Max	-0.24	**1206.27**	-11.63	-6.96	-0.06	0.21
51	(DL+LL)1.5	Min	12.12	797.56	**-29.06**	-15.06	0.05	-4.06
35	(DL+LL)1.5	Max	-45.11	470.08	**37.58**	14.65	-0.10	19.24
51	(DL+LL)1.5	Min	12.12	797.56	-29.05	**-15.00**	0.05	-4.06
35	(DL+LL)1.5	Max	-45.11	470.08	37.57	**14.65**	-0.10	19.24
35	(DL+LL)1.5	Min	-45.11	470.08	37.57	14.65	**-0.11**	19.24
27	(DL+LL)1.5	Max	15.40	844.78	34.54	14.21	**0.24**	-7.07
13	(DL+LL)1.5	Min	29.22	419.14	21.60	9.80	0.06	**-12.45**
35	(DL+LL)1.5	Max	-45.11	470.08	37.57	14.65	-0.10	**19.24**

As per the above analysis

The cost for low income house for one square feet is 1098.

The cost for medium income house for one square feet is 1430.

The cost for high income houses for one square feet is 1543.

CONCLUSIONS

1. For a selection of site, GIS was used instead of manpower. It leads to reduce time and economy.
2. In group housing, when multiple dwelling units are provided as common services it reduces the overall cost of construction.

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